

IN THE CLAIMS

Claim 1 (currently amended). A hybrid blade wind turbine apparatus, comprising:
a helically twisted blade supported for rotation about an axis and having an outer diameter;
a plurality of substantially straight airfoil blades fixed with the helically twisted blade and supported for rotation about the axis, the plurality of airfoil blades mounted outside the outer diameter of the helically twisted blade; and
a turbine mast having a longitudinal axis of rotation and rotatably supporting the helically twisted blade and the plurality of airfoil blades, wherein ~~each of the helically twisted blades~~ ~~blade and the plurality of~~ airfoil blades cooperates in wind conditions to drive the operation of the ~~other of the helically twisted blades and the airfoil blades~~ wind turbine apparatus.

Claim 2 (original). The apparatus of claim 1, wherein the helically twisted blade is provided with air drag reduction means formed as radially segmented helical blades.

Claim 3 (original). The apparatus of claim 1, wherein the airfoil blades are longer than the helically twisted blade.

Claim 4 (original). The apparatus of claim 1, wherein the helically twisted blade and airfoil blades are mounted for rotation within a protective safety cage.

Claim 5 (original). The apparatus of claim 4, wherein the protective safety cage rotatably supports the helically twisted blade, the plurality of airfoil blades and the turbine mast.

Claim 6 (original). The apparatus of claim 5, wherein the protective safety cage is formed of one of a metal wire mesh, a plastic wire mesh, and combinations thereof.

Claim 7 (original). The apparatus of claim 1, wherein the helically twisted blade comprises two helical half wing blades.

Claim 8 (currently amended). The apparatus of claim 7, wherein ~~the respective vane segments are formed of one of fiber glass sheeting, polycarbonate, polyvinyl chloride, aluminum, light steel sheeting, Kevlar, polyurethane, and rubber sheeting material~~ each helical half wing blade is formed of a plurality of elongated vane segments.

Claim 9 (currently amended). The apparatus of claim 7 8, wherein the material used for the vane segments is treated to be UV-light resistive.

Claim 10 (currently amended). The apparatus of claim 7 8, wherein ~~each helical half wing blade is formed of a plurality of elongated vane segments~~ the respective vane segments are formed of one of fiber glass sheeting, polycarbonate, polyvinyl chloride, aluminum, light steel sheeting, Kevlar, polyurethane, and rubber sheeting material.

Claim 11 (currently amended). The apparatus of claim 10 8, wherein each helical half wing blade is formed of between 2 to 9 separate elongated vane segments.

Claim 12 (original). The apparatus of claim 11, wherein, for use in applications of one of elevated height, elevated wind speed, and a combination thereof, each helical half wing blade is formed of between 5 and 9 vane segments.

Claim 13 (original). The apparatus of claim 11, wherein, for use in applications of one of reduced height, reduced wind speed and a combination thereof, each helical half wing blade is formed of between 2 and 6 vane segments.

Claim 14 (currently amended). The apparatus of claim 7 8, wherein each helical half wing blade is substantially smooth-walled and formed of multiple edge-abutting vane components mounted to a transverse support struts carried by the turbine mast.

Claim 15 (original). The apparatus of claim 14, wherein each elongated vane segment has a width in the range of approximately 3 to 11 inches.

Claim 16 (original). The apparatus of claim 15, wherein each elongated vane segment has a width of approximately 11 inches.

Claim 17 (original). The apparatus of claim 14, wherein each elongated vane segment has a thickness in the range of approximately 0.03 to 0.25 inches.

Claim 18 (original). The apparatus of claim 17, wherein each elongated vane segment has a thickness of approximately .2 inches.

Claim 19 (currently amended). The apparatus of claim 1, wherein the helically twisted blade is formed of a plurality of flexible elongated vane segments.

Claim 20 (currently amended). The apparatus of claim 19, wherein the respective flexible vane segments are formed of one of fiber glass sheeting, polycarbonate, polyvinyl chloride, aluminum, light steel sheeting, Kevlar, polyurethane, and rubber sheeting material.

Claim 21 (currently amended). The apparatus of claim 19, wherein the material used for the flexible vane segments is treated to be UV-light degradation inhibited.

Claim 22 (currently amended). The apparatus of claim 19, wherein each flexible vane segment has a fixed edge and a free edge, and the free edge of one flexible vane segment one of at least partially overlaps, and substantially abuts the fixed edge of the next adjacent flexible vane segment.

Claim 23 (currently amended). The apparatus of claim 22, wherein the amount of overlap of the free edge of one flexible vane segment over the fixed edge of the next adjacent flexible vane segment is a distance in the range of from approximately 0 to 2 inches.

Claim 24 (currently amended). The apparatus of claim 22, wherein, during rotational operation, the free edge of each flexible vane segment is adapted to rise up from the fixed edge of the next adjacent flexible vane segment by a separation distance creating separation air slots between respective flexible vane segments.

Claim 25 (original). The apparatus of claim 24, wherein the separation distance is in the range of between approximately 1/8 to 3/4 inch.

Claim 26 (currently amended). The apparatus of claim 24, wherein, during rotational operation, the separation distance created between the radially-outermost mounted flexible vane segments is greater than the separation distance created between the radially-innermost mounted flexible vane segments.

Claim 27 (currently amended). The apparatus of claim 22, wherein an aerodynamically-shaped vane nose bracket mounts the fixed edge of each flexible vane segment.

Claim 28 (currently amended). The apparatus of claim 22, wherein the flexible vane segments are made from a flexible material wherein, during rotational operation, the respective free edges of the flexible vane segments are able to rise up away from the fixed edges of the adjacent flexible vane segments to provide air flow slots therebetween.

Claim 29 (currently amended). The apparatus of claim 19, wherein each flexible vane segment is separated from the next adjacent flexible vane segment by a separation distance creating separation air slots between respective flexible vane segments.

Claim 30 (original). The apparatus of claim 1, wherein the turbine mast is mounted substantially vertically.

Claim 31 (original). The apparatus of claim 1, and wherein the overall outer shape of the wind turbine apparatus is one of substantially cylindrical, conical, frustro-conical, and combinations thereof.

Claim 32 (original). The apparatus of claim 1, and an energy converting device driven by the turbine mast for converting rotational energy into electrical energy.

Claim 33 (original). The apparatus of claim 32, and wherein the energy converting device is one of a direct drive permanent magnet alternator, a belt drive permanent magnet alternator, a direct drive generator, a belt drive generator, a direct drive air motor and a belt drive air motor.

Claim 34 (original). The apparatus of claim 32, and wherein the energy converting device comprises a pressurized air system, including an air motor, an air storage container, and a pressurized air motor-to-electric generator.

Claim 35 (original). The apparatus of claim 1, and wherein the helically twisted blade is twisted, from one end to the other end, though a twist rotation of one of approximately 45°, 90°, 180°, and 270°.

Claim 36 (original). The apparatus of claim 1, and a protective safety enclosure mounted about the helically twisted blade and airfoil blades.

Claim 37 (original). The apparatus of claim 36, and wherein the protective safety enclosure is formed as a support frame carrying a protective wire mesh.

Claim 38 (original). The apparatus of claim 37, wherein the support frame has a support ring member at each end, each support ring member having a central journal hub for rotatably supporting an end of the turbine mast.

Claim 39 (original). The apparatus of claim 38, and wherein the support frame also has at least one central support ring.

Claim 40 (original). The apparatus of claim 38, wherein each support ring member has support struts connecting to a central hub, and at least one support ring and connecting struts are formed to have an inwardly conical shape to permit mounting of an energy conversion device.

Claim 41 (original). The apparatus of claim 37, wherein the support frame is formed of one of tubular metal members, tubular plastic members, and combinations thereof.

Claim 42 (original). The apparatus of claim 41, wherein the support frame is formed of tubular galvanized steel.

Claim 43 (original). The apparatus of claim 37, and a support stand carrying the support frame, and wherein the support frame is adapted to support the turbine mast in one of substantially horizontal, vertical, and angular operational positions.

Claim 44 (currently amended). The apparatus of claim 1, wherein the specification for the shape and design of each of the respective airfoil blades is one of NACA National Advisory Committee for Aeronautics 0015 and NACA National Advisory Committee for Aeronautics 0012.

Claim 45 (original). The apparatus of claim 1, wherein the length of airfoil blades is within range of between substantially 105% to 150% the length of the helically twisted blade.

Claim 46 (original). The apparatus of claim 45, wherein the length of airfoil blades is substantially 120% the length of the helically twisted blade.

Claim 47 (original). The apparatus of claim 1, and a plurality of transverse blade support struts connecting the helically twisted blade to the turbine mast.

Claim 48 (original). The apparatus of claim 47, wherein the helically twisted blade is formed of elongated vane segments.

Claim 49 (original). The apparatus of claim 48, wherein the respective edges of each vane segment substantially abuts the edge of the next adjacent vane segment.

Claim 50 (original). The apparatus of claim 48, wherein each respective edge of a vane segment is a fixed edge.

Claim 51 (original). The apparatus of claim 48, wherein each vane segment has a fixed edge and a free edge, and each free edge one of substantially abuts and overlaps the fixed edge of the adjacent vane segment.

Claim 52 (original). The apparatus of claim 51, wherein during rotational operation, the free edges of the flexible vane segments are adapted to raise up from and lower against the fixed edge of the adjacent vane segment in response to air pressure thereagainst, thereby maximizing rotational torque and minimizing rotational resistance of the helically twisted blade as its helical blade surfaces are respectively presented in windward and leeward conditions.

Claim 53 (original). The apparatus of claim 48, wherein each vane segment is separated from the next adjacent vane segment by a separation distance creating separation air slots between respective vane segments.

Claim 54 (currently amended). The apparatus of claim 1, wherein, for use in applications at heights of substantially 500 feet and lower, the respective airfoil blades comprise a low speed NACA National Advisory Committee for Aeronautics airfoil shape.

Claim 55 (currently amended). The apparatus of claim 1, wherein, for use in applications at heights of substantially 500 feet and above, the respective airfoil blades comprise a high speed NACA National Advisory Committee for Aeronautics airfoil shape.

Claim 56 (original). The apparatus of claim 1, wherein in cross section the shape of each of the respective airfoil blades is symmetrical.

Claim 57 (original). The apparatus of claim 1, wherein the overall diameter for the respective airfoil blades as mounted to the turbine mast is in the range of between approximately 36 inches to 74 inches.

Claim 58 (original). The apparatus of claim 57, and wherein the diameter used for mounting the airfoil blades on the turbine mast for use in elevated height wind speed applications is less than the diameter used for mounting the airfoil blades for use in reduced height wind speed applications.

Claim 59 (original). The apparatus of claim 1, wherein the helically twisted blade and the airfoil blades cooperatively limits the operational rotation at no greater than 3 ½ wing tip speed versus wind speed.

Claim 60 (original). The apparatus of claim 1, and wherein the hybrid blade wind turbine has a turbine aspect ratio, by comparison of the overall turbine width to the overall turbine blade length, in the range of from approximately 1:3 to 3:5.

Claim 61 (original). The apparatus of claim 1, wherein the diameter of the innermost edge of the outer airfoil blades is in the range of approximately 4 to 24 inches greater than the outer diameter of the inner helically twisted blade.

Claim 62 (original). The apparatus of claim 1, wherein the length of the turbine mast is in the range from approximately 8 to 10 feet.

Claim 63 (original). The apparatus of claim 1, wherein the helically twisted blade has a thickness in the range of between approximately 0.03 to .25 inches.

Claim 64 (original). The apparatus of claim 1, wherein each helical blade segment has a width in the range from approximately 3 to 11 inches.

Claim 65 (original). The apparatus of claim 1, wherein each helical blade segment has a length when twisted in the range of from approximately 6 to 9 feet.

Claim 66 (original). The apparatus of claim 1, wherein each airfoil blade has a length in the range from approximately 9.5 to 11.5 feet.

Claim 67 (original). The apparatus of claim 1, wherein the diameter of the helically twisted blade is in the range from approximately 24 to 50 inches.

Claim 68 (original). The apparatus of claim 1, wherein the airfoil blades are formed of one of extruded aluminum, an aluminum sheet construction over foam, molded or extruded plastic polycarbonate, molded or extruded plastic polyvinyl chloride, molded or extruded PVC, and combinations thereof.

Claim 69 (original). The apparatus of claim 1, wherein the cross-sectional thickness of each respective airfoil blade is in the range from approximately 0.5 inch to 1.5 inch.

Claim 70 (original). The apparatus of claim 1, wherein the helically twisted blade has a twist rotation, from end-to-end, of between approximately 45° and 270°.

Claim 71 (original). The apparatus of claim 1, wherein the turbine mast comprises a first mast section, and a second non-contiguous mast section, wherein the first and second mast sections cooperate to support the helically twisted blade and the plurality of airfoil blades, and wherein the first and second mast sections are rotatably supported about the longitudinal axis of rotation.

Claim 72 (original). A hybrid blade wind turbine system comprising a plurality of turbine apparatuses as defined in claim 1, said turbine apparatuses being interconnected to form a network of turbine apparatuses.

Claim 73 (original). The hybrid blade wind turbine system as defined in claim 72, wherein each of the turbine apparatuses are rotatably supported for individual rotation.

Claim 115 (currently amended). A wind turbine apparatus having a hybrid turbine blade assembly operating on a common axis, comprising, a helically twisted blade ~~a~~ rotationally journaled about an axis and having an outer diameter, and substantially straight airfoil blades mounted radially outwardly of the outer diameter of the helically twisted blade.

Claim 116 (original). The wind turbine of claim 115, further comprising a rotationally journaled turbine mast adapted to support the hybrid turbine blade assembly.

Claim 117 (original). The wind turbine of claim 115, and wherein the substantially straight airfoil blades are respectively mounted at diametrically opposed locations about the helically twisted blade.

Claim 118 (original). The wind turbine of claim 115, wherein the helically twisted blade comprises a plurality of elongated helical blade segments each having a radially inward fixed edge and a radially outward free edge.

Claim 119 (original). The wind turbine of claim 115, and wherein the helically twisted blade comprises a pair of helical half blades.

Claim 120 (original). The wind turbine of claim 119, wherein each helical half blade is formed of elongated vane segments, each vane segment having a free edge operable, during rotation, to lift away from the next outwardly adjacent vane segment.

Claim 121 (original). The wind turbine of claim 120, wherein the free edge of a respective blade segment overlaps the fixed edge of the next radially outward blade segment.

Claim 122 (original). The wind turbine of claim 115, wherein the airfoil blades are longer than the helically twisted blade.